(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
13 March 2003 (13.03.2003)

PCT

(10) International Publication Number
WO 03/020154 A1

(51) International Patent Classification[7]: A61C 8/00

(21) International Application Number: PCT/SE02/01585

(22) International Filing Date:
5 September 2002 (05.09.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0102948-7 6 September 2001 (06.09.2001) SE

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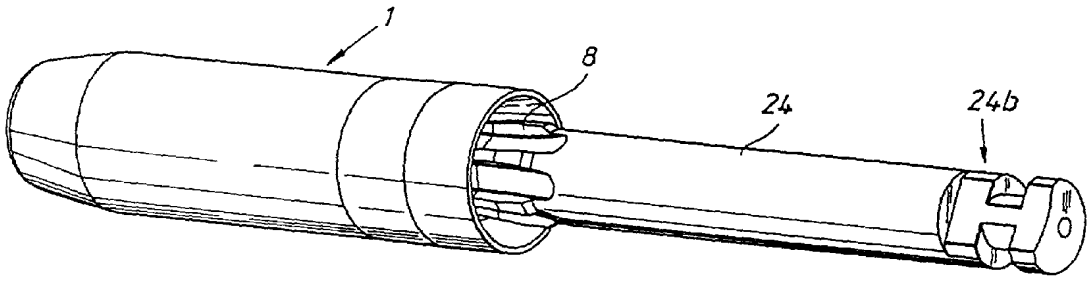
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: IMPLANT, AND TIGHTENING MEMBER AND SPACER MEMBER FOR SUCH AN IMPLANT



(57) Abstract: An implant (1) which can be cooperate with an installation tool (24) and a spacer member (25, 26) and which is arranged with an internal recess which extends from the upper parts of the implant and opens upward, the recess being arranged with first tracks (5) and/or ridges which, seen in cross section of the recess, extend outward from the main periphery (3) of the recess, in which first surfaces (5a) of said first tracks (5) and/or ridges can cooperate with corresponding (opposite) second surfaces (8a) on second ridges (8) and/or tracks arranged on the tightening member (24).

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Implant, and tightening member and spacer member for such an implant.

The present invention relates to an implant (fixture) which can cooperate with a tightening member and spacer member. The implant is arranged with an internal recess which extends from the upper parts of the implant and opens upward or outward, where the recess is arranged with first tracks (grooves) and/or ridges (raised parts, teeth, etc.) which, seen in the cross section of the recess, extend outward from the main periphery of the recess toward the outer wall of the implant. First surfaces of said first tracks or ridges can cooperate with corresponding and opposite second surfaces of second ridges and/or tracks arranged on the tightening member (the installation member or the installation tool). The invention also relates to a tightening member (installation tool) and a spacer member for said implant which at its upper or outer end has a recess which extends downward in the implant and at whose wall there are arranged, extending between the inside of the recess and the outside (wall) of the implant, first tracks and/or ridges (raised parts, teeth, etc.) provided with first surfaces coinciding with the radius of the recess or one or more lines extending parallel to the radius (plane in the longitudinal direction of the implant).

From US patent specification 4 960 381 it is already known to arrange a recess with a hexagonal cross section in the implant, where the corners of the hexagon have been beveled to facilitate entry of the tightening member, for example in the form of a hexagon key.

From SE 9803849-0 (513 111) by the same Applicant as the present application, it is already known to arrange recesses with what is called a "stargrip" function in implants or fixtures, in which a number of tracks are

arranged extending in radial directions from the periphery in a recess of circular cross section. The tightening tool is in this case provided with ridges corresponding to said tracks, and a rotational cooperation between the tool and the implant is obtained via said tracks and ridges or equivalent. In addition, there is a cone-shaped arrangement on the tool which means that the tool can come into cooperation with the implant in a wedge function designed to allow the implant to be driven or carried by means of the tool.

With the Mark-III system generally available on the market from the Applicant (Nobel Biocare AB/SE), it is already known per se, in connection with recesses of the type in question, to use tracks which in the cross section of the recess have the shape of a rectangle or square and where one side surface of the track is arranged coinciding with a line parallel to a radius which, in the cross section of the recess, intersects the center point of the track.

In this kind of arrangement, there is a requirement to obtain a well-coordinated solution in respect of the cooperation function not only between the implant and the tightening tool, but also between the implant and the spacer member. It should be noted here that the production principles hitherto used for testing and producing tooth replacements, for example, can result in considerable clearance in the direction of rotation of the spacer member in relation to the implant, and there is therefore a need to limit such rotational clearance. The cooperation function between the implant and the spacer member, on which the tooth replacement in question is applied, and minimal rotational clearance between the spacer member and the implant are not discussed in the abovementioned references. The object of the present invention is to solve the problem with an optimum cooperation function between, on the

one hand, the implant and the tightening member and, on the other hand, between the implant and the spacer member.

There is also a requirement that said stargrip function can be fully used and that the force of rotation on the spacer member in the implant can be kept relatively high despite small structural dimensions in height and/or in diameter in cases where this is required. In addition, it must be possible to use a circular outer shape of the implant/fixture and at the same time use the carrying capacity or wedge function for the securing member or installation tool. Thus, in a preferred embodiment, there is a need to achieve installation with instruments (installation tools) with a carrying and lifting capacity. It must be possible for the installation tool to be mounted in a relatively simple manner, which can be done by means of the socket lying under a conical countersink. According to the invention, the radially directed surfaces must be able to minimize the pressure which is required to transmit relatively high torsional moments, for example torsional moments of ca. 100 Ncm which can occur in the installation in question. Transmission surfaces which are more tangentially directed (cf. said Swedish patent specification) give a wedging action which results in a higher surface pressure. The invention also aims to solve these problems.

There is a requirement to obtain a low position of the flange for the spacer member's locking screw in order to achieve excellent flexibility (angled positioning) of the prosthetic construction in question. Thus, for example, there may be a requirement for a positional height of the flange which substantially corresponds to the positional height of the implant on the dentine margin. The invention solves this problem too.

There is also a requirement for a spacer attachment on a conical surface which permits easy fitting of the spacer. The conical attachment additionally reduces the risk of hard tissue or soft tissue in connection with the implant or fixture installation. According to the invention, it must also be possible to use a conical attachment which gives an increased pressure between fixture and spacer, which reduces the risk of leakage. There is also a requirement for the stargrip socket to be designed with surfaces which, for a given clearance, minimize the rotational clearance between fixture and spacer. This must also be possible in connection with low spacer heights. The angle of the cone in question must be able to be adapted so that it is possible to attach a bridge (tooth replacement) with normally diverging fixtures without spacers being used while at the same time maintaining a secure attachment. The invention aims to solve these problems too.

That which can principally be regarded as characterizing an implant according to the invention is that at least some of the first and second surfaces are arranged to extend substantially parallel in the radial directions under a rotational action exerted on the implant by means of the tightening member. Further characteristics are that the first tracks and/or ridges (raised parts, teeth, etc.) are arranged to cooperate with third ridges (raised parts, teeth, etc.) and/or tracks on the spacer member upon mutual rotational movements of the implant and of the spacer member, and that the first tracks or ridges are arranged to give the spacer member substantial freedom from clearance or a substantially defined position of rotation in relation to the implant in the mutual directions of rotation of the implant and of the spacer member.

In a first embodiment, the recess opens out in the upper parts of the implant via a first surface which is shaped as a truncated cone and which forms a first

recess part of the recess. Said first recess part merges into a second recess part via the smaller base of said first surface. The second recess part can be arranged with a portion free of tracks or ridges in its inner parts for forming an undercut space which can be used for a snap-fit member, e.g. on impression studs. The recess also comprises a third recess part with an internal thread into which a screw for securing the spacer member on the implant can be screwed. In an alternative embodiment, a cylindrical partial recess is used as first recess part, in which the tracks and/or ridges extend upward and connect with the top of the implant (mouth of the recess).

Further characteristics of the implant are set out in the attached dependent claims under claim 1.

That which can principally be regarded as characterizing a tightening member (installation tool) is that the tightening member is arranged with second ridges (raised parts, teeth, etc.) and/or tracks which have second surfaces which, upon a rotational movement of the tightening member relative to the implant, can be set substantially parallel to the first surfaces of the implant, and that, upon said rotational action, one of the second ridges (raised parts, teeth, etc.) and/or tracks causes rotational force(s) substantially at right angles to the first surfaces.

That which can principally be regarded as characterizing a spacer member according to the invention is that the spacer member is arranged with third ridges (raised parts, teeth, etc.) and/or tracks which have surfaces which can be set substantially opposite the first surfaces of the implant. Further characteristics are that the first and third tracks and ridges and the first and third surfaces are arranged with a substantial pass fit accuracy which prevents any

substantial rotational clearance between the spacer member and the implant.

Further developments of the spacer member according to the invention are set out in the attached dependent claims for the spacer member.

By means of what has been stated above, a countersunk connection geometry can also be used upon installation or screwing-in of the screw-type implant. The new interface between implant and installation tool is based on the stargrip function being used and on the stargrip socket also being used for spacer attachment. The arrangement can be provided with or without countersinking in the implant. In a preferred embodiment, ridges or teeth are used on the tool and the spacer, which ridges or teeth cooperate with tracks in the recess of the implant. In principle, the positions of the tracks, teeth or ridges can be changed around so that ridges or teeth in the implant cooperate with tracks in the installation tool and the spacer. In one embodiment, the track and ridge arrangement can be combined so that the implant has on the one hand tracks and on the other hand ridges and the tool and the spacer member have corresponding ridges or tracks. According to the invention, the cooperating surfaces between the tool and the implant will be substantially parallel, while other surfaces in the track or ridge arrangement can have different configurations and angles. Thus, each track can have the shape of a triangle, although quadrangles in the form of squares and rectangles are preferred. As a result of what has been proposed above, the rotational clearance can be reduced between spacer member and implant, high torsional moments can be transmitted with the installation tool to the implant, and small installation dimensions can be used for the spacer member.

A presently proposed embodiment of implant, installation tool and spacer member having the characteristics significant to the invention will be described below with reference to the attached drawings, in which:

Figure 1 shows an end view, in partial cross section, of the implant from its upper or outer end, and with a tooth arrangement on an installation tool being partly shown,

Figure 2 shows, in an end view from the upper or outer end of the implant, a track arrangement in the implant, and at the same time ridges or teeth on a spacer member partially shown in cross section,

Figure 3 shows, in an end view and partial cross section, parts of the implant according to Figures 1 and 2 and a partially shown tooth arrangement on installation tool and spacer member,

Figure 4 shows a first embodiment of an implant in longitudinal section,

Figure 5 shows the implant from Figure 4 in a perspective view,

Figure 6 shows, in longitudinal section, parts of the implant in a second embodiment,

Figure 7 shows, in longitudinal section, the implant in a third embodiment which can cooperate with a partially shown spacer member,

Figure 8 shows, in longitudinal section, parts of the implant and an installation tool with stargrip function,

Figure 9 shows a perspective view of the implant and tool from Figure 8,

Figure 10 shows, in longitudinal section, the implant and a spacer member applied thereon,

Figure 11 shows a perspective view of the spacer member according to Figure 10, and

Figure 12 shows a perspective view of a second embodiment of the spacer member.

In Figure 1, an implant fixture is indicated by 1. The implant can be an implant known per se, for example an implant from what is called the Brånemark system. The implant is not shown in detail, but only in the respect relevant to the invention. The present implant is provided with a cylindrical wall 1a and an internal recess 2 which has the shape of a truncated cone and whose broader part (base) forms the mouth in or at the upper parts of the implant and whose lower part (base) merges into a circular recess 3. Said circular recess merges in turn into a second circular recess 4 with an internal thread 4a which has been partially shown. The circular recess 3 is provided with a number of tracks which in the present case are 6 in number. The number of tracks can be chosen within the range of 4-10, said number of tracks preferably being 6-10. The tracks in the present case are of identical configuration and each track has a first surface 5a which constitutes a front surface in the drive function. The track additionally comprises a rear surface 5b which is used in the drive function when the implant is to be acted upon in order to unscrew it. Each track additionally comprises a base surface 5c which preferably follows an inscribed circle 6 which extends through all the base surfaces in the different tracks, but which has been shown only in part in the figure. The tracks can have

the shape of quadrangles (with rounded corners) in the form of rectangles (see the figure) or squares. The extent of the first surface 5a or (main) part of the first surface is important in this case. In Figure 1, a radius R1 is indicated which extends through central parts 5d of the tracks in question. The first surface 5a will then coincide with a line 7 or a plane which extends at right angles to the plane of the figure in Figure 1. According to the invention, the line or plane in question will be substantially parallel to the radius R1. Figure 1 also shows a second radius R2 which extends through one of the tracks discussed above. A ridge or tooth on a used tightening member or installation tool is indicated by 8. A characteristic of the ridge or tooth in question is that it has a second surface 8a through which there extends a line 9 or a plane at right angles to the plane of the figure in Figure 1. A characteristic of the extent of the line 9 or plane is that it is substantially parallel to the radius R2. The surface 8a is used when the tool is driven in the clockwise direction 10. The ridge or tooth 8 is also provided with a rear surface 8b which cooperates with the rear edge (cf. 5b) of the track if the implant is to be unscrewed. The tool is also provided with an outer surface 8c which has a wedging function (described in more detail below) which is used for support of the implant with or by the installation tool. The rear edges 5b of the tracks can be arranged with an inclination so that configurations other than the rectangular shape shown (or square shape) can be obtained, for example a triangular shape.

In Figure 2, the cooperation of the implant with a spacer member has been shown in principle. The spacer member is represented in Figure 2 by means of teeth 11, 12 and 13 which are applied in respective recesses 5. The last-mentioned recesses 5 are also indicated in Figure 2 by the surfaces 5a, 5b and 5c. The ridges or teeth on the spacer member have a shape corresponding

to the shape of the respective tracks 5 in the implant. Thus, the ridge of each spacer member is provided with side surfaces 11a and 11b and with an outer boundary surface 11c. A characteristic of each spacer member ridge is that the side surfaces 11a and 11b in question adjoin or are intersected by a line 14 or a plane which extends at right angles to the plane of the figure in Figure 2. A characteristic of the spacer member ridge is that the line 14 in question is substantially parallel to the respective radius R3 which extends through the central parts of the track 5 (see Figure 1). Said parallelism must be present for at least the surface 11a, while the side surface can have a different extent (see the arrangement according to Figure 1). A characteristic of the shapes of the ridges on the spacer member is that a small clearance is present between the side surfaces 5a, 5b and 11a, 11b. In this way, a small rotational clearance between the spacer member and the implant is obtained. In a preferred embodiment, the rotational clearance is of the order of 0.01 mm. Values of around 0.02 mm can also be used, or values lying between said values. The number of ridges in the spacer member can be the same as the number of tracks in the implant or, alternatively, can be less than said number of tracks.

Figure 3 shows, in an enlarged view compared to Figures 1 and 2, a preferred embodiment of the track configuration in the implant and of the ridge configuration on the tool or spacer member. The front surface 8a on the tool ridge 8 engages the first surface 5a substantially parallel, i.e. the lines 7 and 9 for the track and ridge, respectively, are substantially coincident in this function. The tightening force in the clockwise direction (see Figure 1) generates in each track and ridge function a rotational force F which, by virtue of the arrangement shown, can be comparatively high and can, for example, assume values of up to 10 Newton. The unscrewing

function is obtained by cooperation between the surfaces 5b and 8b and is of substantially the same order. During unscrewing, the lines 7' and 9' substantially coincide and retain their substantial mutual parallelism. In the case shown, the spacer member 11 is centered in the track 5. The abovementioned distance a is in this case divided into part distances a1 and a2 on each side of the ridge or equivalent. The lines for the front and rear surfaces 11a and 11b in question are indicated by 14, 14' in Figure 3. The number of ridges on the tool can be the same as the number of tracks in the implant or, alternatively, can be less than the last-mentioned number of tracks.

According to Figure 4, the circular recess mentioned above is divided into three partial recesses 15, 16 and 17. The first partial recess is formed by the abovementioned cone-shaped surface 15a. The ridges 18 extend along most of the second partial recess 16. In addition, the ridges extend partially up into the first partial space, which extent b can constitute 1/4 - 1/3 of the length of the first partial recess in the longitudinal direction of the implant. The ridges 18 end at a distance from the extent of the second partial recess 16 so as to form an undercut in the inner parts of the second partial recess 16, which undercut can form a securing member for a snap-fit member (not shown) which is used in the tooth replacement production (e.g. on impression studs) in a manner known per se. The second partial recess merges into the third partial recess 17 which consists of a screw hole for a locking screw (not shown in the figure) for a spacer member (not shown in the figure).

Figure 5 shows a perspective view of the implant from Figure 4 with associated ridges 18 and cone-shaped surface 15a.

Figure 6 shows an alternative embodiment with a longer cone-shaped surface 15a. The length l and the cone angle α can be chosen as a function of the installation situation. In the present case according to Figures 4 and 6, the length l has a value which is about 10-20% of the total length of the implant. The angle α is chosen within the range of 30°-90° and in the particular case shown is ca. 60°.

According to the embodiment in Figure 7, the circular recess can be designed with another arrangement of partial recesses. Thus, it includes a recess 16' (fourth recess) in which the tracks extend along most of the length of the partial recess. In this case, use is made of a fifth partial recess 20 and a sixth partial recess 17', the last-mentioned having a shape and function corresponding to those of the partial recess 17 in Figure 4. In this case, therefore, the surface shaped as a truncated cone (see 15a, 15b) is absent. In Figure 2, a spacer member 21 with ridges or teeth 22 is symbolically indicated which can cooperate with tracks in the first partial recess. The second partial recess 20 in this case functions as a guide for a part 23 bearing the ridges or teeth 22.

Figure 8 shows the cooperation between the implant 1 and an installation tool 24 which can be of a type known per se. Reference is made in this connection to, inter alia, the Swedish patent specification mentioned in the introduction. The difference from the previously known construction is attributable to the above-described arrangement of tracks, ridges or teeth. The tool 24 comprises a cone-shaped part 25 which effects the abovementioned wedging function for supporting the implant with the tool. The tool is driven with its front parts 24a through the first partial recess 15 so that its teeth cooperate with the tracks arranged in the second partial recess. The front parts 24a of the

tool are in this case arranged so that they permit introduction into the third partial recess 17.

In Figure 9, the tool 24 is shown with a socket arrangement for a drive device (e.g. drill machine) of suitable type (not shown in Figure 9). The application in the implant or fixture 1 otherwise corresponds to what is shown in Figure 8.

Figure 10 shows the case where a spacer member 25 is applied in an implant or a fixture 1 which has been screwed into a bone 26 (e.g. jaw bone) by means of a tool according to Figures 8 and 9. The spacer member is secured by means of a screw 27 in a manner known per se. The spacer member has a cone-shaped outer surface 25a which is adapted with great precision to the internal cone of the implant, see the illustrative embodiments according to Figures 4 and 6 where the internal cones in question have been indicated by 15a and 15a'. The spacer member is intended, in a manner known per se, to support a tooth replacement, bridge part, etc., which has been indicated in principle by 28. A characteristic of the arrangement according to Figure 10 is a low installation height for the spacer member, which low installation height has been indicated by c. The value of the height c can be between 5 and 10 mm. The illustrated arrangement with a cone-shaped outer surface 25a extending partially above the implant 1 effects or permits a very good incorporation function in the dentine, cf. above description of problems. The arrangement also means that a support flange 25b of the spacer member 25 acquires a low or drawn-in position for a bearing surface 27a on the head 27b of the tightening screw. Said drawn-in position lies substantially at the same height as the outer surface 1d (or free surface) of the implant 1 which is placed at the outer surface 26a of the dentine 26. The prosthetic construction 28 can in this way be positioned at a considerable angle in

relation to the implant, cf. the angle α′ between the longitudinal axis 1e of the implant and the main longitudinal axis 28a of the construction. The considerable angled position can be effected without the head of the tightening screw forming an obstacle or disturbing the outer angling of the construction 28.

Figure 11 shows a perspective view of the spacer member in question which is used in the illustrative embodiment according to Figure 10. In the present case, the ridges, teeth, etc. 11 are arranged on a cylindrical part 23′ (see the illustrative embodiment according to Figure 7). The arrangement permits small installation dimensions with respect to the diameter d of the cylindrical part, which diameter can be chosen within the range of 8-12 mm.

If an even smaller diameter is wanted, the arrangement according to Figure 12 can be used. In this case, the ridges or teeth are arranged on or form protruding elements 29 which are arranged alongside one another in a ring-shaped configuration. In this case, a diameter d′ can be further reduced in relation to the case according to Figure 11 with the diameter d.

Said tracks can be considered as extending in the radial direction as seen from the center line 1a (or inside) of the implant, see Figures 1, 2 and 6. The tracks are thus located in the implant wall and extend from this in a direction out toward the outer surface 1b of the implant (see Figure 1). The outer surface of the implant is indicated by 1b in Figure 1, and the upper or outer end of the implant is indicated by 1c in Figure 4. According to Figure 6, the longitudinal direction of the implant is indicated by means of the longitudinal axis 1a. The snap-fit member in question can be arranged on an impression stud. The cone-shaped surface arrangement between the implant and the spacer member allows the inside of the implant to be

effectively sealed off from the outer parts of the implant and spacer member, which among other things prevents penetration into the inside of the implant from the external atmosphere. A characteristic of the recess in question, which is made up of said partial recesses, is that it preferably has a cylindrical configuration or cylindrical configurations. The arrangement gives the spacer member a substantially defined position of rotation (freedom from clearance) relative to the implant.

The invention is not limited to the embodiment shown above by way of example, and instead it can be modified within the scope of the attached patent claims and the inventive concept.

PATENT CLAIMS

1. An implant (1) which can cooperate with an installation tool (24) and spacer member (25, 26) and which is arranged with an internal recess which extends from the upper parts of the implant and opens upward (outward), the recess being arranged with first tracks (5) and/or ridges which, seen in the cross section of the recess, extend outward from the main periphery (3) of the recess, in which first surfaces (5a) of said first tracks (5) and/or ridges can cooperate with corresponding (opposite) second surfaces (8a) on second ridges (8) and/or tracks arranged on the tightening member (24), characterized in that at least some of the first and second surfaces are arranged to extend substantially parallel in the radial directions of the recess under a rotational action (10) on the implant (1) by means of the tightening member, in that the first tracks (5a) and/or the ridges are arranged to cooperate with third ridges (11) and/or tracks on the spacer member (25, 26) upon mutual cooperation of the implant and of the spacer member, and in that the first tracks or the ridges are arranged to give the spacer member substantial freedom from clearance or a substantially defined position in relation to the implant in the direction(s) of rotation.

2. The implant as claimed in patent claim 1, characterized in that the recess opens out in the upper parts (1c) of the implant via a first surface (15a, 15a') which is shaped as a truncated cone and which forms a first recess part (15) of the recess, and in that the broader base of the first widened part forms the mouth of the recess, and the narrower base of the recess part merges

into a second recess part (16) provided with a substantially cylindrical inner surface.

3. The implant as claimed in patent claim 2, characterized in that said first tracks and/or ridges are arranged in the second recess part and extend substantially in the longitudinal direction of the implant.

4. The implant as claimed in patent claim 2 or 3, characterized in that said first tracks and/or ridges are arranged to extend over parts of the first recess part (15).

5. The implant as claimed in patent claim 2, 3 or 4, characterized in that said first tracks and/or ridges extend at least over parts of the surface shaped as a truncated cone, preferably from the narrower part of the surface and by a distance, e.g. 1/4 - 1/3, upward/outward toward the broader part of the first surface.

6. The implant as claimed in any of patent claims 2 - 5, characterized in that the second recess part (16) is arranged free of tracks or ridges in its inner parts for forming an undercut space (19) below the tracks and/or the ridges, which undercut space constitutes a securing member for a snap-fit member, e.g. on impression studs.

7. The implant as claimed in any of patent claims 2-6, characterized in that the recess is arranged with an inner third recess (17) which adjoins the second recess part (16) via a second surface or bevel designed as a truncated cone, and in that the third recess part is arranged with an internal thread or internal threads for a tightening screw (27) for the spacer member.

8. The implant as claimed in any of patent claims 5, 6 or 7, characterized in that the spacer member is arranged with a cone-shaped surface (25a) corresponding to the surface (15a, 15a') shaped as a truncated cone, and in that said cone-shaped surfaces (15, 15a' and 25a) are arranged in such a way that, when the spacer member is in its position applied on the implant, they generate substantial sealing of the inside of the implant from the outer parts of the implant and spacer member.

9. The implant as claimed in any of the preceding patent claims, characterized in that the first tracks and/or ridges of the implant are arranged to receive the spacer member (25) with third tracks and/or ridges (11) which, at the front in the centering part of the spacer member in the implant's recess, are arranged with forwardly diminishing or downwardly beveled second ridges and/or tracks.

10. The implant as claimed in any of the preceding patent claims, characterized in that the first tracks and/or ridges of the implant are arranged to receive spacer member (25) with third tracks and/or ridges arranged on a substantially cylindrical front part (23, 23') on the spacer member or on forwardly projecting free-standing elements (29) arranged alongside one another on the spacer member.

11. The implant as claimed in patent claim 1, characterized in that the recess comprises three recess parts, here called fourth, fifth and sixth recess parts (16', 20, 17'), and in that the outer recess part (16') is arranged with the first tracks and/or the ridges which in this case extend

out into the mouth of the outer recess part or the upper parts (1c) of the implant.

12. The implant as claimed in patent claim 1 or 11, characterized in that the second recess part serves as inner guide parts for the third ridges and/or tracks on the spacer member.

13. The implant as claimed in patent claim 11 or 12, characterized in that the outer recess part (16') is substantially cylindrical.

14. The implant as claimed in any of the preceding patent claims, characterized in that the number of first tracks and/or ridges is 4-10, the number preferably being 6-8, and/or in that the number of first tracks and/or ridges is equal to or exceeds the ridges and tracks in the spacer member and/or the tool.

15. The implant as claimed in any of the preceding patent claims, characterized in that the first tracks and/or ridges and the second ridges and/or tracks are arranged to transmit substantially high torsional moments, e.g. 100 Ncm.

16. The implant as claimed in any of the preceding patent claims, characterized in that the spacer member's bearing surface (25b) for the lower head surface (27a) of the locking screw (27) assumes a low or substantially drawn-in position relative to the upper or outer surface (1d) of the implant (1), it being possible in this connection for a prosthetic construction (28) to be given a relatively great angle (α) in relation to the longitudinal axis of the implant.

17. The implant as claimed in any of the preceding patent claims, characterized in that it is

arranged to receive spacer members of relatively small diameter (d, d'), e.g. 2.5-3 mm.

18. The implant as claimed in any of the preceding patent claims, characterized in that the cone-shaped surfaces are chosen with a cone angle (α) in the range of 20°-60°.

19. The implant as claimed in any of the preceding patent claims, characterized in that a respective first track or ridge is intersected by a given radius (e.g. R1) in the recess, as viewed in the cross section of the recess, at its central parts (5d), and in that the first surface (5a) of the track or of the ridge which can be exposed to a respective second surface of a respective second and third ridge or track extends along a line (9, 11) parallel to said radius or a parallel plane.

20. The implant as claimed in any of the preceding patent claims, characterized in that the first tracks and/or ridges are arranged to receive the second ridges and/or tracks with a clearance precision of ca. 0.01-0.02 mm.

21. The implant as claimed in any of the preceding patent claims, characterized in that the respective first, second and third track or ridge in the cross section of the recess has the shape of a triangle or quadrangle.

22. A tightening member (installation tool) (24) for an implant (1) which at its upper or outer end (1c) has a recess extending down in the implant, at whose wall there are arranged, extending between the inside of the recess and the outside (1b) of the implant, first tracks and/or ridges with first surfaces (5a) coinciding with the radius (R1) of the recess or one or more lines (7,

9 and 7', 9') or planes parallel with the radius, characterized in that the tightening member is arranged with second ridges and/or tracks (8) which have second surfaces (8a) which, upon a rotational movement of the tightening member relative to the implant, can be set substantially parallel to the first surfaces (5a), and in that upon said rotational action, the force of rotation or forces of rotation caused by the second ridges and/or tracks is/are substantially at right angles to the first surfaces.

23. A spacer member for implant (1) which at its upper parts (1c) or outer end has a recess which extends down in the implant and at whose wall there are arranged, extending between the inside of the recess and the outside (1b) of the implant, first tracks and/or ridges with first surfaces coinciding with the radius of the recess or one or more parallel lines (14, 14') parallel with the radius, characterized in that the spacer member is arranged with third ridges and/or tracks (11, 12, 13) which have surfaces which can be set substantially opposite the first surfaces, and in that the first and third tracks and ridges and the first and third surfaces are arranged with a substantial pass fit accuracy which prevents any substantial rotational clearance between the spacer member and the implant.

24. The spacer member as claimed in patent claim 23, characterized in that the third ridges and/or tracks are arranged on a substantially cylindrical front part (23, 23') or on forwardly protruding elements (29) which are arranged alongside one another.

Fig. 1

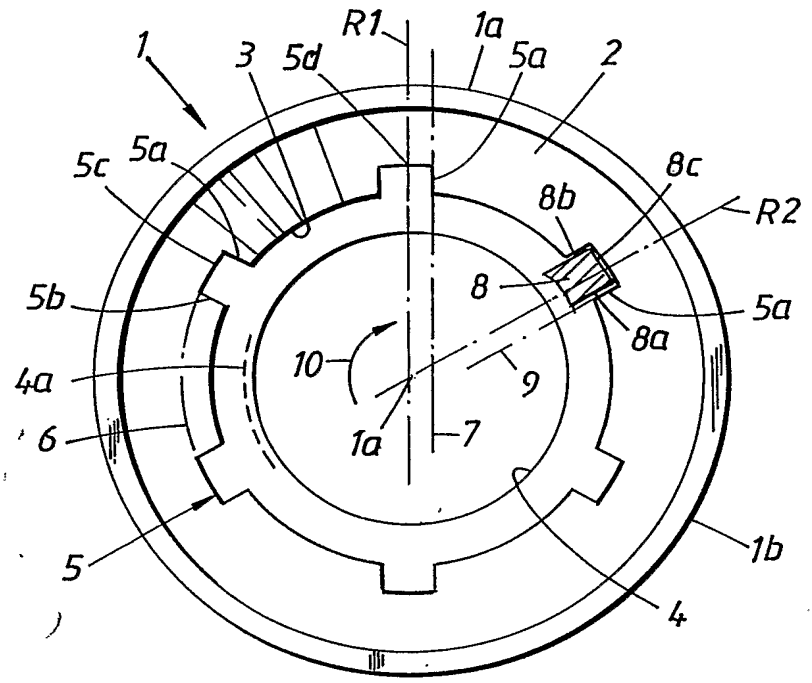

R1
1a
1
3
5d
5a
2
5c
5a
8c
8b
R2
8
5a
5b
8a
10
9
4a
1a
7
6
5
1b
4

Fig. 2

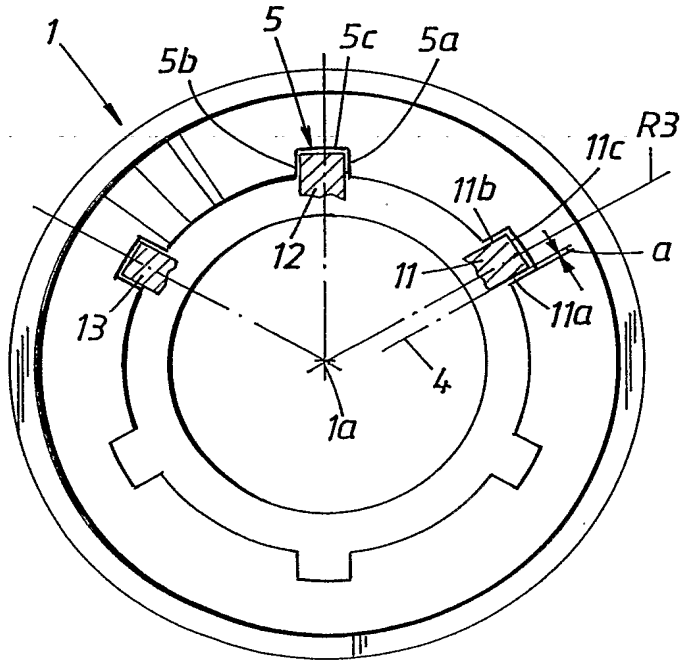

1
5
5c
5a
5b
R3
11c
11b
12
a
11
13
11a
4
1a

Fig. 3

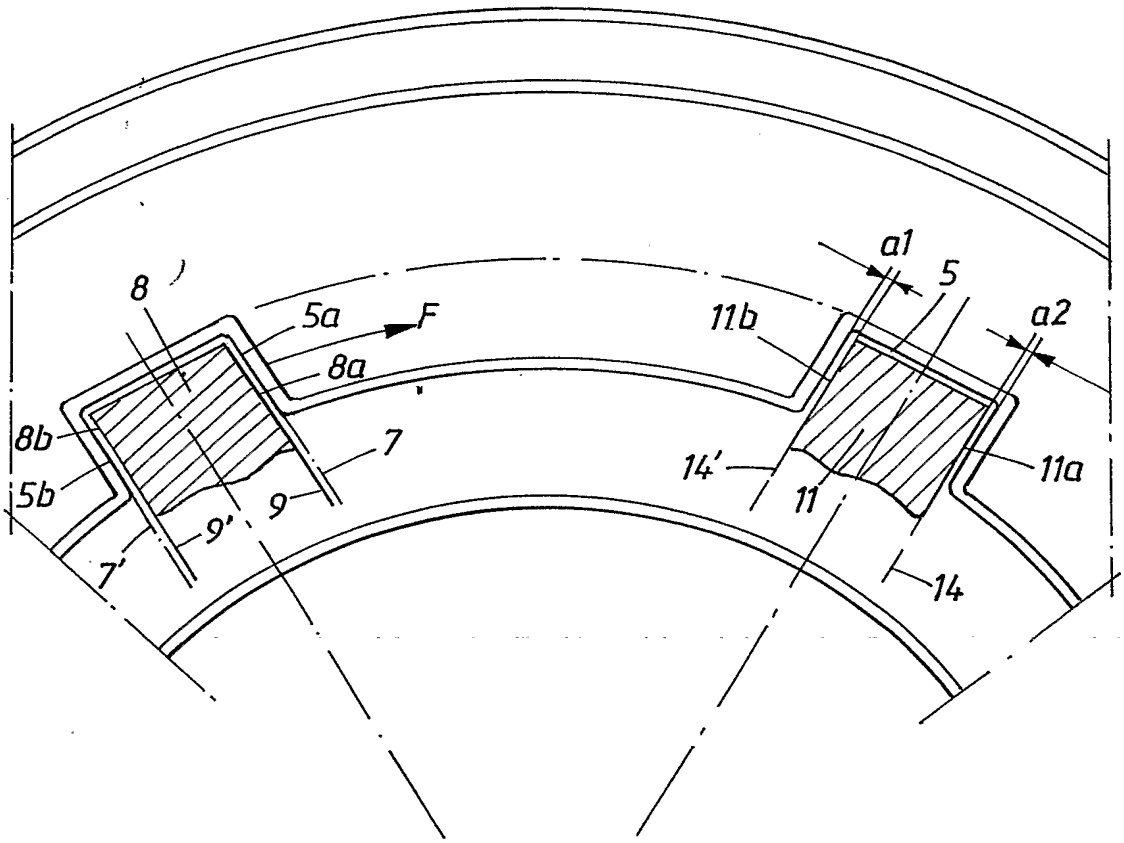


Fig. 4

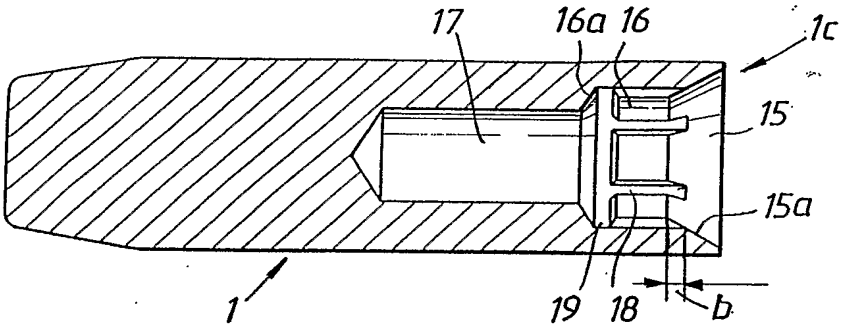


Fig. 5

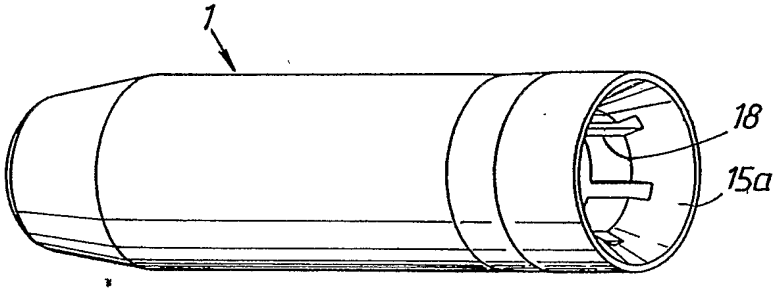


Fig. 6

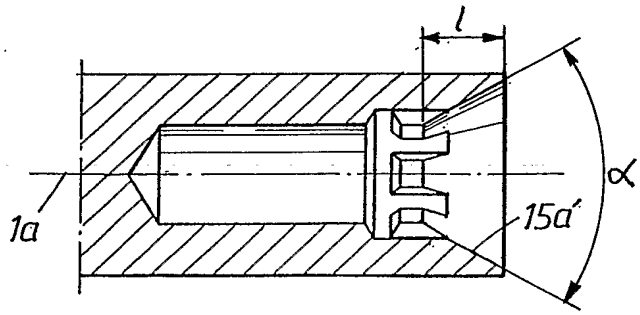
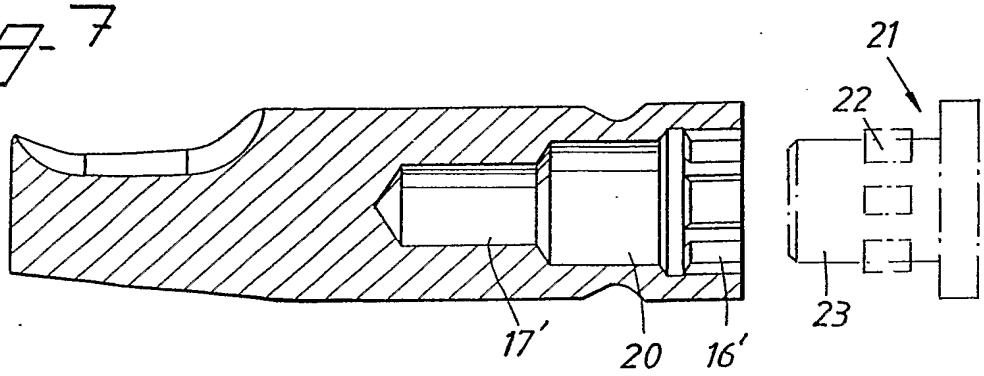


Fig. 7



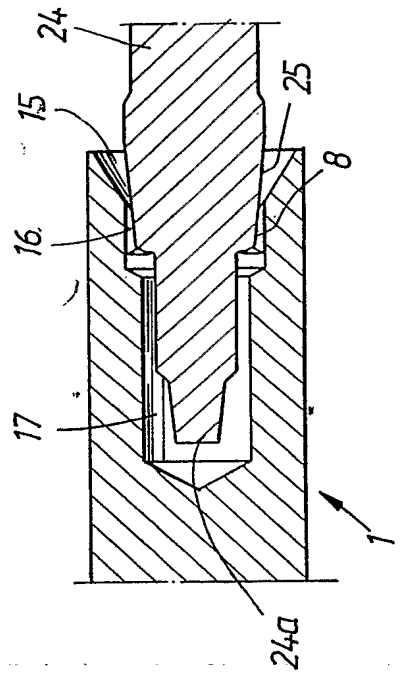


Fig. 8

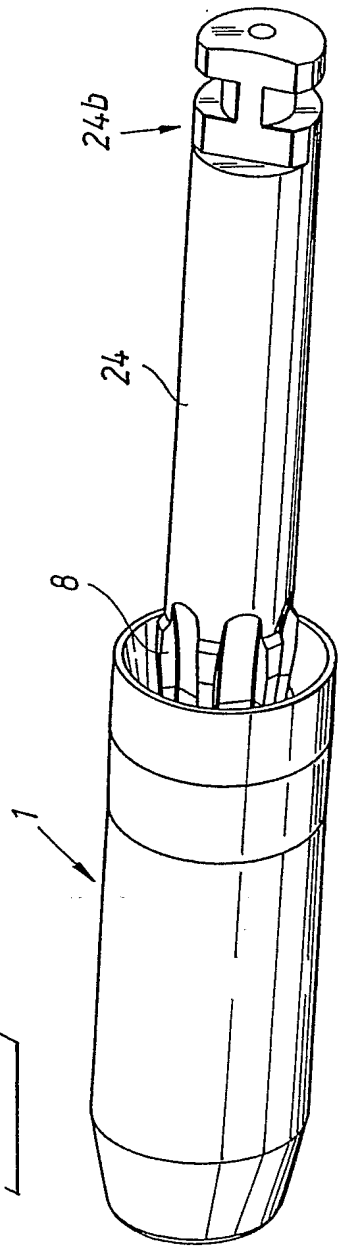


Fig. 9

Fig. 10

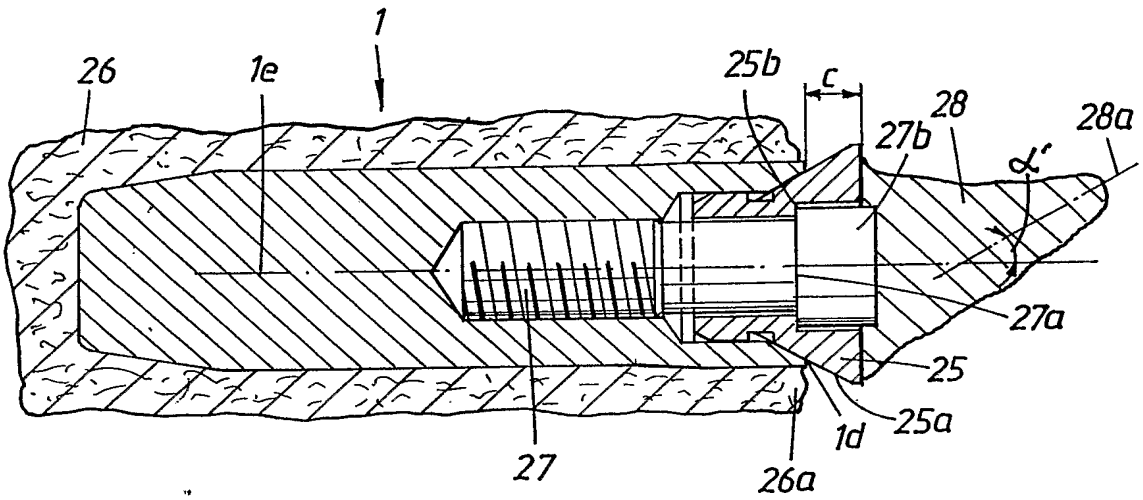


Fig. 11

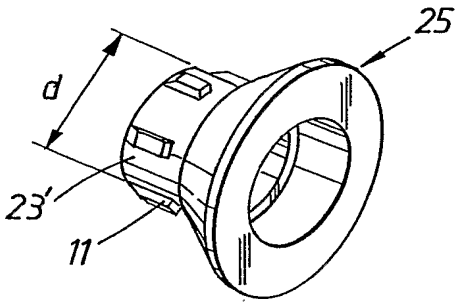
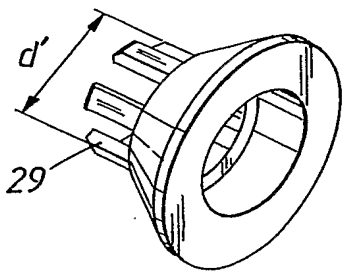


Fig. 12



INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 02/01585

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A61C 8/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: A61C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 0027300 A1 (NOBEL BIOCARE AB), 18 May 2000 (18.05.00), figures 1-8, claims 1-17	1-24

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☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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"E" earlier application or patent but published on or after the international filing date
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 December 2002	13 -12- 2002
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Agneta Änggård/Els Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

28/10/02

International application No.
PCT/SE 02/01585

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0027300 A1	18/05/00	AU 1592300 A	29/05/00
		EP 1128778 A	05/09/01
		SE 513111 C	10/07/00
		SE 9803849 A	12/05/00